the vicinity of waterfalls or in the depths of narrow, sunless ravines. In many of its ecological characters it resembles the endemic *Gunnera petaloidea*.

The native Hawaiian name for *Hillebrandia* is *Pua-maka-nui*, literally "the flower with the big eyes," referring to the large, showy flowers, which contrast strongly with the gloom of its habitat. On the island of Kauai it is known as *Ala-aka-awa;* the Kauai natives use many names and words which are used in no other parts of the islands. The rhizomes of many begonias, particularly those of South America, are bitter and astringent, and are used medicinally by the natives of those countries. It does not appear that the primitive Hawaiians used *Hillebrandia* in any way, although it should be stated that much of the medicinal lore of ancient Hawaii has been irrevocably lost.—VAUGHAN MACCAUGHEY, *College of Hawaii, Honolulu.*

SECONDARY PARASITISM IN PHORADENDRON

BROWN'S[1] illustration of *Phoradendron californicum* parasitic on *P. flavescens*[2] has a twofold interest. First, it records a case of secondary parasitism which seems to be very rare indeed. It has never, so far as I am aware, been noted by workers at the Desert Botanical Laboratory, a number of whom have been especially interested in parasitism. For the most part *P. macrophyllum* and *P. californicum* occur on quite different hosts.[3] Second, the case is of interest physiologically, as BROWN suggests, in its relation to osmotic and other physical phenomena. HARRIS and LAWRENCE, in their study of the sap properties of Jamaican montane rain forest Loranthaceae,[4] find that in these forms the sap extracted from the green stems of the leafless species shows lower osmotic concentration than that from the foliar tissues of the leafy forms. Thus in working with 7 species of Loranthaceae they found average values of the freezing point lowering of 1.153°, 1.176°, and 1.177° in the leafless species as compared with 1.305°, 1.347°, 1.400°, and 1.650° in

[1] BROWN, J. G., Mistletoe vs. mistletoe. BOT. GAZ. **65**:193. *fig. 1.* 1918.

[2] This is presumably *P. macrophyllum* Cockerell, the *P. flavescens macrophyllum* of ENGLEMANN and of some subsequent workers, or one of its varieties. The host here, as Professor BROWN has kindly written me, was a *Fraxinus.*

[3] TRÉLEASE (The genus *Phoradendron*, p. 14, Urbana. 1916) notes that *P. californicum*, while occurring exclusively on angiosperms, belongs to a group, the "Pauciflorae," which with this and one other exception is limited to coniferous hosts.

[4] HARRIS, J. ARTHUR, and LAWRENCE, J. V., On the osmotic pressure of the tissue fluids of Jamaican Loranthaceae parasitic on various hosts. Amer. Jour. Bot. **3**:438–455. 1916.

the leaves of the leafy forms. If the same is true of desert Loranthaceae, the relationship between leafless and leafy parasite observed by BROWN is just the reverse of what might be expected if successful parasitism were dependent upon higher osmotic concentration in the tissue fluids of the parasite.

As pointed out elsewhere, however, the technical difficulties in the comparison of the tissue fluids of the stems and leaves by the methods as yet available for field work are rather great. In the leafless forms there is danger of including a considerable amount of fluids from woody conducting tissue not at all comparable with that of the green tissue which may be taken to be physiologically homologous with the leaf tissue of the leaves of the tree or of the leafy Loranthaceae. Furthermore, such work as has been done on the rather difficult problem of the physico-chemical properties of the tissue fluids of desert Loranthaceae[5] is insufficient to show that the osmotic concentration is lower in the leafless desert forms. Furthermore, the concentration of the sap of desert forms seems to vary rather widely, and even if the average concentration of the fluids of *P. californicum* were lower than that of *P. macrophyllum*, it is quite possible that the individual secondary parasite, *P. californicum*, had a higher concentration than its individual *P. macrophyllum* host.[6]

So far as I am aware, the only direct determination of osmotic concentration in primary and secondary parasitism in the Loranthaceae is that by HARRIS and LAWRENCE (*loc. cit.*) on the Jamaican broad-leaved *Phthirusa parvifolia* parasitic upon the leafless *Dendrophthora gracilis*, which is in turn parasitic upon a tree, *Cyrilla racemiflora*. The sap properties stand in the following relationship: *Cyrilla racemiflora*, $\Delta = 1.18$, $P = 14.2$; *Dendrophthora gracilis* (on *Cyrilla racemiflora*), $\Delta = 1.26$, $P = 15.2$; *Phthirusa parvifolia* (on *Dendrophthora gracilis*), $\Delta = 1.49$, $P = 17.9$. Osmotic concentration increases from the host to the primary parasite and from the primary parasite to the secondary one. Note also that the observed secondary parasitism is the *leafy P. parvifolia* with an average depression of $1.347°$ upon the *leafless D. gracilis* with an average depression of $1.176°$.—J. ARTHUR HARRIS, *Cold Spring Harbor, N.Y.*

[5] HARRIS, J. ARTHUR, On the osmotic concentration of the tissue fluids of desert Loranthaceae. Mem. Torr. Bot. Club **17**:307–315. 1918.

[6] I have individual determinations on *P. californicum* which indicate higher concentration than some found in *P. macrophyllum*. The great difficulty of comparing the sap properties of the two forms lies in the fact that, in the neighborhood of Tucson at least, they occur in the main on different hosts and for the most part in slightly different local habitats.